A synopsis of

"Green Synthesis of Silver Nanoparticles Using *Nigella sativa* (Black cumin) seeds and its Ecofriendly Application as Antimicrobial agent"

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“Green Synthesis of Silver Nanoparticles Using *Nigella sativa* (Black cumin) seeds and its Ecofriendly Antimicrobial agent”

Abstract

In terms of crop productivity and monetary loss, phytopathogenic fungi are the main fungi that damage agricultural foods. Control of phytopathogenic fungi has evolved into one of the world's most pressing issues. novel technology with application potential in many fields, including agriculture is nanotechnology. Using plant leaf extract to create nanoparticles during the nanotechnology process is a cost-effective, eco-friendly, and non-toxic method. Silver is a frequently used for synthesis of silver nano particles (AgNPs) because of chemical stability, electrical & thermal conductivity, high catalytic activity, antimicrobial activity. *Nigella sativa* seeds have been used as a spice and food preservative**.** Ethyl acetate extract of *Nigella sativa* fungus completely inhibited fungal biomass**.** *Nigella sativa* plant extract is used for synthesis of silver nanoparticles (AgNPs) followed by characterization of silver nanoparticles done by UV-Vis spectrophotometer whereas recognition done by TEM, SEM etc. microscopic techniques. The antimicrobial activity with bioassay technique by employing common phytopathogenic fungi.

Introduction

Nanotechnology is an interdisciplinary research field. In recent past efforts have been made to improve agricultural yield through exhaustive research in nanotechnology. Numerous applications of nanotechnology are effective in managing plant diseases. The most popular is applying nanoparticles to seeds, soil, and leaves to prevent infection or protect plants from pathogens. There are two ways that the nanoparticles are employed to protect plants. Spray application is one method of applying nanoparticles that serve as pesticide carriers. Nanoparticles themselves shield crops from harm. Using nanoparticles as carriers can have a number of advantages. extends the shelf life of pesticides and improves their solubility in water, increasing their site-specific uptake by the target Pest. In recent past efforts have been made to improve agricultural yield through exhaustive research in nanotechnology. Green nanoparticle synthesis is easy to do, inexpensive, produces nanoparticles that are stable, take up little time, don't produce any harmful byproducts, and are environmentally benign. It can also be scaled up quickly for large-scale synthesis. The plant extract of *Nigella sativa* contains secondary metabolites which plays a critical role during the nanoparticle synthesis acting as a reducing or

capping agents. Studies have shows that silver nanoparticles are highly stable, large surface area fraction of surface atoms as a result have large antimicrobial activity.

Review of Literature

The *N. sativa* seed may be used as reducing and capping agent the reduced silver nanoparticles was identified using FTIR analysis.*(Elnosary et al., 2022).* Numerous investigations on Nigella sativa have been conducted to support its use in traditional medicine as an analgesic, immunological stimulant, antihypertensive, anti-inflammatory, anti-fungal, anti-microbial, and anti-cancer agent.(*Mobe*en *et al.*). Applications of metal-based nanoparticles (MNPs) for sustainable food security and agriculture.*(Sh*ende *et al., 2022).* Black cumin's essential oil's antioxidant and antibacterial properties are frequently used by the food industry to improve the nutritional, sensory, and storage aspects of food products.(Mohammed *et al., 2021).* Thymohydroquinone and thymol are the most efficient compounds for suppressing pathogenic yeasts, dermatophytes, nondermatophytic filamentous fungi, and fungi that create aflatoxin.(Shokri, 2016). When *N. sativa* is applied as an insecticide to Rhyzopertha dominica the majority, or about 44% concentration, of mortality have been recorded.(Staff, 2018). A study using magnetite nanoscale to examine black cumin extract revealed that it is a powerful inhibitor of the *Didymella bryonie* fungi's growth, which cause gummy stem blight in the Cucurbitaceae family of plants.(Khalil, 2018). Using the Poison Food Technique, thymoquinone was the most effective, with minimum inhibitory concentration values of 7.0 and 8.5 ppm against *Colletorichum gloeosporoi*des and *Penicillium digitatum*.(Akansha *et al., 2023).* Black cumin cake extract (BCCE) and zinc oxide nanoparticles (ZnONPs) are added to gelatin/polyvinyl alcohol (G/PVA) films to prevent microbiological deterioration and oxidative rancidity of packaged foods.(Tymczewska *et al.,* 2022). Nanosizing the toxicity of *Nigella sativa* against a multicellular organism (S. feltiae) with agricultural application reduces the survival of nematodes after 24 h to about half, i.e., to 40% and 50% respectively.

Objective of Research

- To collect plant seed of *N. sativa* for synthesis of nanoparticles.
- To prepare seed extracts using various techniques.
- To synthesis sliver nanoparticles by using aqueous extract of plant seed of *N. sativa.*
- To characterize the synthesized silver nanoparticles by spectrophotometer.
- To detect AgNPs by advance techniques.

- ❖ To study antimicrobial activity of AgNPs particles against test organism(microbes).
- ❖ To study Minimum Inhibitory Concentration (MIC) of synthesized green particles.

Methodology to be Adopted

1. Collect the seed of *N. sativa* plant and grind it to fine powder.
2. Perpetration of *N. Sativa* seed extract to synthesize silver nanoparticles by using silver nitrate.
3. Characterization by spectrophotometric analysis using UV-Vis Spectrophotometer.
4. Detection of silver nanoparticles by using transmission electron microscope.
5. Confirmation of silver nanoparticles.
6. Confirmation of silver nanoparticles by SEM.
7. Study of antimicrobial activity of silver nanoparticles by bioassay techniques using test organism (bacteria & fungi).

Importance of Study & Society Application

Many scientists are attempting to create nanoparticles that are less expensive, more environmentally friendly, simpler to use, and widely used in fields like medicine, the environment, agriculture, etc.

International Status

Against soil-borne fungus species *Fusarium oxysporum* and *Macrophomina phaseolina*, the vegetative portions of *Nigella sativa* L. have antifungal action.(Aftab *et al.*, 2019). *Nigella sativa* oils have outstanding antifungal properties that are effective against Phytofungi. (Sitara *et al.,)*.

National status

Many Indian researchers are working to produce silver nanoparticles utilizing environmentally friendly methods. By increasing the distribution of plant growth regulators, nutrients, and pesticide active components to selected target areas in plants, nanotechnology aids in the development of agriculture. (Gupta *et al.,* 2023).According to Rajashri R. Thigle (2014) Compared to *Lawsonia inermis*, *Nigella sativa* exhibits stronger effectiveness against Candida albicance. (Thigle & Nitave, *n.d.*).

Significance of Study

- **Fungicide:** *Nigella sativa* is naturally a fungicide when NPs of these can used as fungicides in agriculture.
- **Preservative:** *Nigella sativa* is used as traditional spice in for preservative recently it is also used in industry level for preservation .
- **Delivery System:** It has been found that NPs play a very significant role as delivery systems in agricultural research for the improvement of crops.

Purposed work Plan

1. Preparation of seed extract.
2. Preparation of silver nanoparticles using silver nitrate.
3. Stabilization study with UV-Vis Spectrophotometer.
4. Detection of silver nanoparticles (NPs) by SEM & TEM.
5. Antimicrobial study against test organism & phytopathogen.

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